The Tribe Noviini in the New World (Coleoptera: Coccinellidae)

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ABSTRACT

The genera and species belonging to the tribe Noviini in the New World are reviewed. The genus *Vedalia* is removed and placed in the Exoplectrini. Four new *Anovia* species, *punica, peruviana, weisei* and *mexicana*, are described. Keys to genera and species are included, and pertinent morphological characters are illustrated.

Korschefsky (1931) lists 5 genera in the Noviini. All of these except *Eurodolia* Weise (1895) and *Novius* Mulsant (1850) are represented in the New World. One genus, *Vedalia* Mulsant, is at present erroneously included in the Novini and is here placed in the Exoplectrini near *Chnoodes* Chevrolat. With *Vedalia* removed, the tribe Novini becomes an easily defined, compact group characterized as follows: dorsal surface with dense, short pubescence, finely and densely punctured; head with labrum obviously on a lower plane than clypeus; eye densely pubescent, not emarginate; antenna 8-segmented, basal segment expanded (fig. 1); prosternum with intercoxal process protuberant, extending beyond the anterior coxa (except *Novius*); tarsus trimerous; abdomen with 6 visible sterna, apical sternum more or less emarginate in male (figs. 6, 7); postcoxal line narrow, complete or nearly so.

It is quite possible that some of the species presently placed in *Novius* will have to be transferred to *Rodolia*. A series of specimens from Australia identified as *Novius bellus* Blackburn in the USNM collection belongs to *Rodolia*, and chances are excellent that at least some of the Australian species belong to *Rodolia* also. To further complicate matters, my preliminary examination of male and female genitalia suggests that at least some of the Australian and Asian species presently in *Rodolia* should be removed to other genera. Lack of specimens of many species has prevented a complete study at present.

Rodolia cardinalis (Mulsant) is perhaps the best known member of the Noviini, at least in North America, due to the publicity given the successful control of the cottony cushion scale. *Rodolia cardinalis* was introduced into California from Australia by Albert Koebele. Less well known, but as effective a predator of cottony cushion scale, is *Rodolia koebelei* (Coquillett), also introduced from Australia by Koebele.

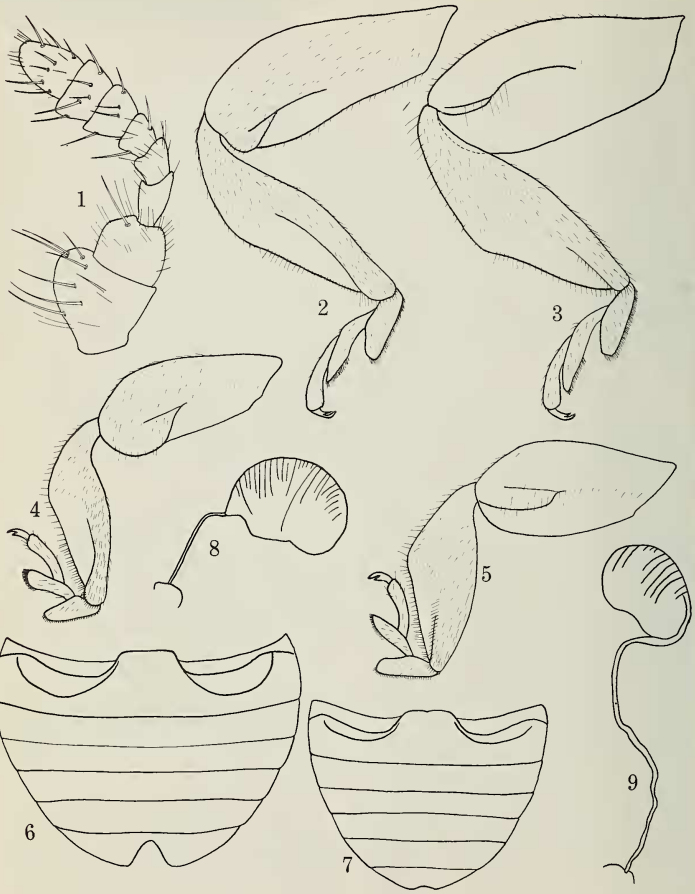

Fig. 1; *Anovia virginalis*, antenna. Fig. 2; *Rodolia cardinalis*, front leg. Fig. 3; *Rodolia cardinalis*, hind leg. Fig. 4; *Anovia virginalis*, front leg. Fig. 5; *Anovia virginalis*, hind leg. Fig. 6; *Rodolia cardinalis*, male abdomen. Fig. 7; *Anovia virginalis*, male abdomen. Fig. 8; *Rodolia cardinalis*; spermatheca. Fig. 9; *Anovia virginalis*, spermatheca.

Key to genera of New World *Noviini*

Prosternum with intercoxal process densely pubescent, margined anteriorly; pronotum with sides not completely arcuate, posterior angles apparent ..... Rodolia Mulsant

Prosternum with intercoxal process sparsely pubescent, not margined anteriorly; pronotum with sides completely arcuate, posterior angles not apparent ..... Anovia Casey

Genus **Rodolia** Mulsant

Rodolia Mulsant, 1850, p. 280. Type-species: *Rodolia ruficollis* Mulsant, by subsequent designation of Crotch, 1874, p. 280. Korschefsky (1931) mistakenly records *rubea* Mulsant as the type species of *Rodolia*.

Macronovius Weise, 1885, p. 63 (subgenus of *Rodolia*).–Weise, 1895, p. 149 (synonym of *Rodolia*).–Sicard, 1907, p. 68.–Korschefsky, 1931, p. 98.

Priore (1963) gives an exhaustive account of the internal and external morphology of the adult and immature stages of *Rodolia cardinalis* (Mulsant). Priore's findings will not be reiterated here. Priore does not illustrate the receptaculum seminis which is short, stout, lacks an accessory gland, and has a relatively short sperm duct (fig. 8).

Rodolia and *Anovia* adults are quite difficult to separate on the basis of morphological characters and the temptation to unite the 2 genera would be great if it were not for larval characters. Rees (1947) compared the larvae of *R. cardinalis*, *R. koebelei* and *A. virginalis* (Wickham) and found those of *Rodolia* to have 2-segmented antennae, while those of *Anovia* have only 1 segment. This, with adult characters and differences in distribution, warrant the continued separation of the genera.

Key to the New World species of *Rodolia*

Elytron always red with numerous black markings ..... cardinalis (Mulsant)

Elytron varying from entirely red to red with an elongate, sutural spot and broad black spot laterally ..... koebelei (Coquillett)

Rodolia cardinalis (Mulsant)
Fig. 2, 3, 6, 10, 11, 12

Vedalia cardinalis Mulsant, 1850, p. 906.
Novius cardinalis: Crotch, 1874, p. 283.
Eurodolia cardinalis: Weise, 1895, p. 150.
Rodolia cardinalis: Weise, 1905, p. 220.–Weise, 1916, p. 50 (*Macronovius* group).
Rodolia aegyptiaca Sicard, 1907, p. 67.–Korschefsky, 1931, p. 99.
Macronovius cardinalis: Weise, 1922, p. 104.
Macronovius cardinalis ab. *obnubilatus* Weise, 1922, p. 104.–Korschefsky, 1931, p. 99.

Male and Female.–Length 2.65 to 4.18 mm, width 2.00 to 3.33 mm. Form elongate, elytron nearly parallel-sided, widest at middle. Color red, basal area of pronotum and head black; meso- and metasternum, femora and median area of first 2 abdominal sterna piceous; elytron with black maculation. Front leg with tibia and femur narrower than hind leg (fig. 2). Hind leg with tibia broad, femur with pubescence nearly absent on inner side (fig. 3). Male abdomen with last segment deeply emarginate medially (fig. 6). Male genitalia short, stout; basal lobe bent upward in apical one-third; paramere abruptly widened, sides parallel in apical one-half (fig. 10, 11); sipho wide, widened at base with a dorsal projection (fig. 12).

Type locality.–"la Nouvelle Hollande (collect. Hope)".

Type depository.–Oxford University, England.

Distribution.–Australia, southern Europe, North and South Africa, Java. North and South America.

The elytral color pattern is quite constant considering the wide geographic range of this species. The elytral variation is limited primarily to the partial fusion of some of the spots. The basal balck area on the pronotum may entirely cover the pronotum.

Rodolia cardinalis has had a confused history of generic placement. Mulsant (1850) erred when he placed *cardinalis* with the New World species *sieboldii* In the genus *Vedalia*. Crotch (1874) further confused the matter by placing *cardinalis* in the genus *Novius* and erroneously transferring 2 Mulsant species from *Rodolia* to *Vedalia*. The name *Macronovius* was proposed by Weise (1885) as a subgenus of *Novius* Mulsant for *Novius limbatus* Motschulsky and *Rodolia*

concolor Lewis. The character used to separate *Novius* s. str. and *Macronovius* was the presence of an expanded and emarginate tibia allowing for the concealment of the tarsus in *Macronovius*, the tibia not being expanded or emarginate in *Novius*. Weise apparently was not aware that *Rodolia* had an expanded, emarginate tibia. In 1895, Weise again discussed *Novius* and related genera, describing a monobasic new genus, *Eurodolia*, and giving a key to separate *Novius*, *Rodolia* and *Eurodolia*. He listed 15 species of *Rodolia*, divided them into 2 unnamed groups on the basis of whether the claws were toothed or cleft, and *limbatus*, the type species of *Macronovius*, was placed in the first group (claws toothed). In the same paper he stated that *Macronovius* was a synonym of *Rodolia*. After the description of *Eurodolia* he stated that *Vedalia cardinalis* might belong in *Eurodolia*. In 1905, Weise placed *cardinalis* in *Rodolia*, stating that it belonged in the *Macronovius* group because of the toothed claws. In 1916, Weise referred to "*Eurodolia cardinalis*" from "W. Australien" (sic). In 1922, Weise referred again to "*Macronovius cardinalis*", describing an aberration, *obnubilatus*. Korschefsky (1931) treated *Macronovius* as a synonym of *Rodolia* and placed *cardinalis* in *Rodolia*. There is little doubt that this arrangement is correct. I have examined several species of *Rodolia* and have concluded that the claw character Weise used to separate his 2 groups within the genus is sexual. Males have a cleft claw and females have only a basal tooth on the claw.

Rodolia koebelei (Coquillett)
Fig. 13, 14, 15

Novius koebelei Coquillett, 1893, p. 20.–Lea, 1901, p. 493.–Leng, 1920, p. 214.
Rodolia koebelei: Korschefsky, 1931, p. 101.

Male and Female.–Length 2.55 to 3.10 mm, width 2.00 to 2.65 mm. Form elongate-oval, widest anterior to middle of elytra. Color red; pronotum and head black; meso- and metasternum and legs except tarsi piceous; elytron with a dark brown, elongate area on suture, a small. lateral, submarginal spot medially. Male abdomen with last sternum slightly emarginate. Male genitalia elongate; basal lobe flattened dorso-ventrally, broad, narrowed to a blunt tip at apical one-sixth; paramere narrow (fig. 13, 14); sipho wide, base unmodified (fig. 15).

Type locality.–Los Angeles, California.
Type depository.–USNM (neotype here designated).
Distribution.–Australia, California.

The elytra vary from completely red to having large sutural and lateral areas dark, these dark areas becoming contiguous postmedially.

Coquillett (1893) was apparently the first to describe *koebelei*, and he did so by describing the egg, 4 larval instars, and the pupa. No adult description was given. Lea (1901) stated that the name *koebeli* was a manuscript name in the A. S. Olliff collection and that the species was introduced into the United States under this name. There are 3 larvae and 1 pupa of *koebelei* in alcohol in the USNM collection received from Coquillett in 1892. There is no indication that these are actually the specimens upon which Coquillett based his description, but they were received from him and are possibly type material. There are also 7 first-instar and 1 second-instar larvae mounted on points in the USNM collection which may also be type material, as well as several adults, all labeled "5575". In addition, the adults are labeled "Coquillett, Los Angeles, Calif.", which is the type locality. Since it cannot definitely be established that these immature stages are type material, no lectotype is designated here. A neotype is here selected instead, a fourth-instar larva in the USNM alcohol collection matching Coquillett's description and bearing the label "No.-896 P.O.-13 No.-16, Rodolia (Vedalia n. sp.) on Icerya". Larval specimens of *R. cardinalis* bearing the same data are also labeled "Los Angeles, Calif., July '92, Coquillett", so it is assumed that the neotype of *koebelei* is also from Los Angeles.

Anovia Casey
Fig. 1, 4, 5, 7, 9

Anovia Casey, 1908, p. 408. Type species: *Scymnus virginalis* Wickham, by monotypy.

Head pubescent, clypeus thick, labrum on a distinctly lower plane than clypeus; eye finely faceted, pubescent, not emarginate; antenna 8-seg-

mented, club 3-segmented (fig. 1); maxillary palpus with last segment large, securiform. Pronotum pubescent, deeply emarginate anteriorly, finely margined laterally and posteriorly in middle, hind angle obliterated, evenly rounded. Elytron pubescent, short, stiff setae present internally, lateral margin slightly explanate, epipleuron descending externally, not foveolate for reception of legs. Prosternum with intercoxal area strongly protuberant, extending beyond coxa, usually sparsely pubescent, not margined anteriorly. Proleg with femur deeply emarginate apically for reception of tibia (fig. 4); meso- and metafemora shallowly emarginate apically for reception of tibiae (fig. 5); tarsus 3-segmented. Abdomen with postcoxal line shallow, complete or nearly so, last sternum emarginate in male (fig. 7). Male genitalia with basal lobe curved upward and apex more or less bent downward in lateral view; paramere long, slender; sipho long, slender, pointed at apex, expanded basally. Female genitalia with receptaculum seminis short, stout, narrowed basally, lacking cornu and accessory gland (fig. 9).

Anovia is the only known native New World member of the Noviini; it closely resembles *Rodolia*, differing as noted in the generic key and discussion of *Rodolia*. Until now *virginalis* (Wickham) has been the only species placed in *Anovia*. A syntype of *Zenoria circumclusa* Gorham was loaned by R. D. Pope of the British Museum, and this species belongs in *Anovia* rather than *Zenoria* (Gordon, 1971).

Key to species of *Anovia*

Each elytron dark with a median red spot of varying size and sometimes a red subhumeral area 2
Each elytron unicolorous or red with a dark submarginal band 3
Epipleuron red or light reddish brown; elytron with a red subnumeral area ..... virginalis (Wickham)
Epipleuron black or piceous; elytron without a red subnumeral area ..... mexicana, n. sp.
Elytron black; inner margin of eye not parallel, farther apart at lower margin than at upper margin; peru ..... peruviana, n. sp.
Elytron not black; inner margin of eye usually nearly parallel; not known from Peru 4
Male genitalia with basal lobe broad in ventral view, abruptly narrowed at apical one-third (fig. 23); dorsal color usually purple or reddish brown ..... punica, n. sp.
Male genitalia with basal lobe not as described above; dorsal color variable 5
Dorsal color reddish purple; pronotum with lateral one-third red; male genitalia with apical one-half narrower than basal one-half in ventral view (fig. 26) ..... weisei, n. sp.
Dorsal color uniformly red or red with a dark submarginal border; male genitalia with basal lobe slender, evenly tapered to apical point in ventral view (fig. 19) ..... circumclusa (Gorham)

Anovia virginalis (Wickham)
Fig. 16, 17, 18

Scymnus virginalis Wickham, 1905, p. 166.
Anovia virginalis: Casey, 1908, p. 408

Male and Female.–Length 2.43 to 3.05 mm, width 2.00 to 2.44 mm. Form elongate-oval, widest anterior to middle of elytron. Color red; pronotum except anterior angle, head, and basal portion of femur piceous; elytron with a median red spot and a subhumeral red area. Male abdomen with last sternum slightly emarginate medially (fig. 7). Male genitalia with basal lobe broad, pointed, very slightly bent downward at apex, ventral surface with lateral margin extending inward medially; paramere long, narrow (fig. 16, 17); sipho slender, pointed, basal end abruptly expanded (fig. 18).

Type locality.–Chad's Ranch, Utah (Virgin River Valley).

Type depository.–USNM.

Distribution.–United States: Arizona, New Mexico, Texas, Utah. Mexico: Sonora, San Luis, Vera Cruz, Victoria.

The red median spot on each elytron varies from a small discal area to a large spot occupying most of the elytron. This species has been recorded as attacking *Steatococcus plucheae* (Cockerell) and *Icerya rileyi* Cockerell in New Mexico.

Anovia circumclusa (Gorham)
Fig. 19, 20, 21, 31, 32, 33, 34

Zenoria circumclusa Gorham, 1899, p. 262.–Korschefsky, 1931, p, 108.–Blackwelder, 1945, p. 443.
Anovia circumclusa: Gordon, 1971, p. 1.

Male and Female.–Length 2.60 to 3.10 mm, width 2.43 to 2.59 mm. Form elongate-oval,

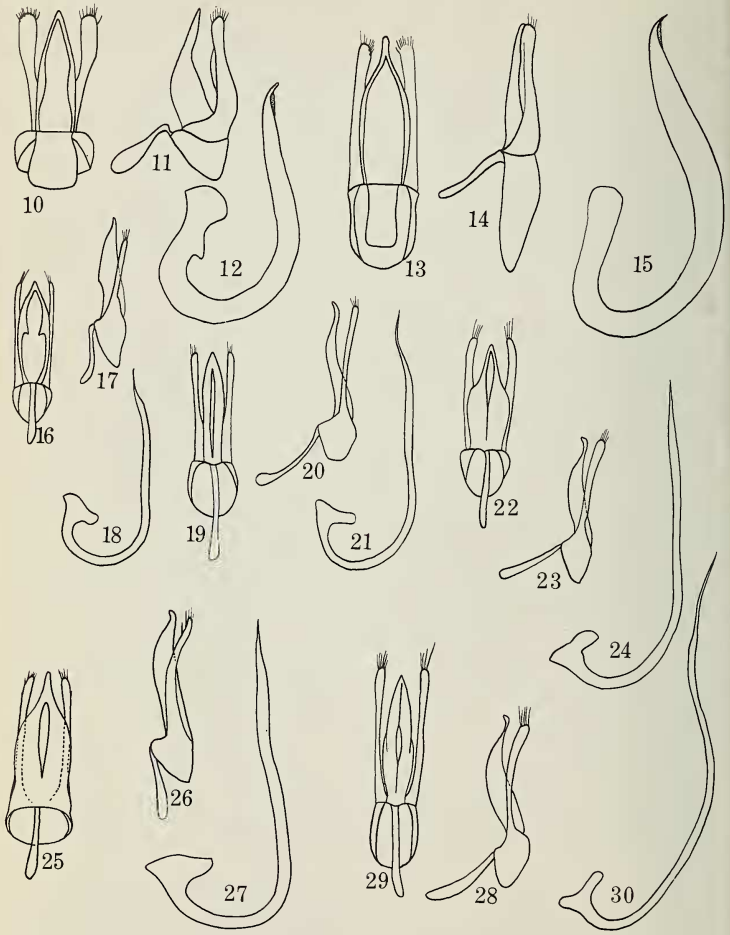

Fig. 10-30, male genitalia. Fig. 10-12, *Rodolia cardinalis*. Fig. 13-15; *Rodolia koebelei*, Fig. 16-18; *Anovia virginalis*. Fig. 19-21; *Anovia circumclusa*. Fig. 22-24; *Anovia punica*. Fig. 25-27; *Anovia mexicana*. Fig. 28-30; *Anovia weisei*.

widest anterior to middle of elytra. Color reddish yellow; a black band completely encircling elytron and extending onto basal part of pronotum, discal spot and elytral margin reddish yellow (fig. 31); ventral surface pale yellow. Male abdomen with last sternum slightly emarginate medially. Male genitalia with basal lobe long, slender, curved downward at apex, in ventral view evenly tapered to pointed apex; paramere long, slender (figs. 19, 20); sipho slender, pointed, gradually curved upward near apex, basal end abruptly expanded (fig. 21).

Type locality.—Panama; Volcan de Chiriqui.

Type depository.—British Museum (lectotype here designated).

Distribution.—Guatemala: Salama. Honduras: Tegucigalpa; La Ceiba. Mexico: Tampico. Panama: Volcan de Chiriqui.

The specimens from Tampico lack the black zonate band on the elytron. The male genitalia of the Tampico specimens are identical to those of the zonate specimens, and since this zonate color pattern is quite variable in several genera of Neotropical Coccinellidae, these specimens are here considered to be *circumclusa* (fig. 32-34). A syntype of *circumclusa* in the British Museum bearing the following labels is here designated lectotype: "Syntype"; V. de Chiriqui, 4000-6000 ft., Champion"; "circumclusa Gorham."

Anovia punica, n. sp.
Fig. 22, 23, 24

Male.—Length 3.42 mm, width 2.97 mm. Form oval, widest anterior to middle of elytra. Color reddish purple; narrow lateral margin of elytron, anterior margin and angles of pronotum and ventral surface red. Head finely punctured, punctures separated by 1 to 2 times their diameter; covered with grayish white, semi-decumbent pubescence; inner margin of eye nearly parallel. Pronotum finely punctured, punctures separated by 1 to 4 times their diameter; covered with grayish white, semi-decumbent pubescence. Elytron finely punctured, punctures separated by 2 times their diameter; covered with grayish white, semi-erect pubescence. Abdomen with last sternum slightly emarginate. Genitalia with basal lobe broad, abruptly narrowed to a blunt point in apical one-third; paramere long, slightly widened apically (fig. 22, 23); sipho long, slender, apex pointed, base suddenly expanded (fig. 24).

Female.—Similar to male in all respects except sexual characters.

Variation.—Length 3.00 to 3.30 mm, width 2.71 to 3.00 mm. Four specimens from Colombia have the dorsal surface entirely red with no trace of purple. Two specimens from Trinidad have the dorsal surface red with the black band as in typical *circumclusa*.

Holotype.—Male. Venezuela: Edo. Aragua, Maracay, 22-VII-41, C. H. Ballou, eating *Icerya purchasi* (USNM 71725).

Paratypes.—Total 83. Colombia: Candelaria, 17-X-39; La Esperanza, Feb. 21, 1938, L. M. Murillo; Buga, 21-II-38, L. M. Murillo. Honduras: La Ceiba, March 21-20, WM Mann. Panama: Canal Zone, Oct. 29, 1918, F. F. Dietz; Cristobal, Canal Zone, July 5, 1918, H. F. Dietz, Zetek & Molina; Panama City, July 30, 1918, H. F. Dietz; XX Plantation, Feb. 11, 1930, Blackwelder. Trinidad: Warren, III, 1953, F. D. Bennett; Balandra, Feb. 1965, F. D. Bennett; V-9-1911, A. Busck. Venezuela: same data as holotype; El Valle, C. H. Ballou; Yuma, E. Carabobo, 3-VI-1950, F. Fernandez. (USNM) (Inst. Zoology. Agric., Maracay, Venezuela).

This species has been recorded feeding on *Icerya purchasi* Maskell and *Icerya montserratensis* Riley and Howard in Venezuela and Panama.

The color pattern shows the same range of variation from red to red with a zonate band to dark purple that is found in several species of *Zenoria* and *Epilachna*, as well as *A. circumclusa*. In some instances, particularly in *Zenoria*, this is apparently linked with the maturity of the specimens, but this does not seem to be the case for *A. punica*.

Anovia mexicana, n. sp.
Fig. 25, 26, 27

Male.—Length 3.00 mm, width 2.60 mm. Form oval, widest anterior to middle of elytra. Color black; narrow lateral margin of pronotum, labrum and entire ventral surface except epipleuron and pro- and mesosternum red; elytron with a small, red discal spot. Head finely punctured, punctures separated by their diameter; covered with grayish white, semi-decumbent pubescence; inner margin of eye nearly parallel. Pronotum finely punctured, punctures separated by their diameter or less; covered with grayish white, semi-decumbent pubescence. Elytron finely punctured, punctures separated by less than to twice their diameter; covered with grayish white, semi-erect pubescence.

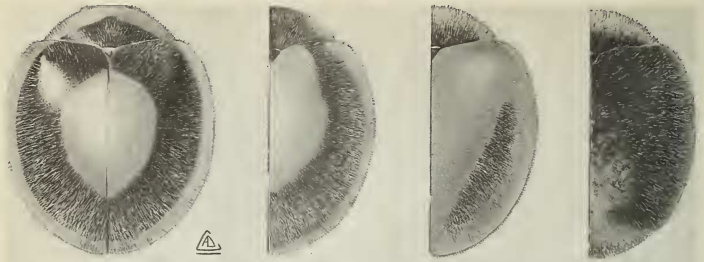

Fig. 31-34; habitus views, *Anovia circumclusa*.

Abdomen with last sternum feebly emarginate. Genitalia with basal lobe broad, narrowed to a blunt point in apical one-third; paramere slender, angled upward in apical one-third (fig. 25, 26); sipho short, broad, apex pointed (fig. 27).

Female.–Similar to male except last abdominal sternum more deeply emarginate.

Variation.–Length 3.00 to 4.00 mm, width 2.60 to 3.48 mm. The red, discal spot on the elytron is slightly larger in some specimens than others.

Holotype.–Male. Mexico: Morelos, 16 mi. south Cuernavaca, Aug. 22, 1958, H. Howden (Canadian National Collection, Ottawa).

Paratypes.–Total 4. Mexico: Guerrero, 17 mi. N. Mexcala, Aug. 23-24, 1958, H. F. Howden; Guerrero, 13 mi. N. Chilpancingo, Aug. 25, 1958, H. F. Howden; Guerrero, 8 mi. N. Iguala, Aug. 23, 1958. H. F. Howden. (CNC) (USNM)

The male genitalia of this species are nearest those of *punica* but the sipho is short and stout in *mexicana*, long and slender in *punica*. In addition the dorsal color is predominantly black in *mexicana*, reddish purple in *punica*. In external appearance *mexicana* resembles *virginalis*, but *mexicana* is larger and has the punctures on the head and pronotum denser than does *virginalis*.

Anovia weisei n. sp.
Fig. 28, 29, 30

Male.–Length 4.00 mm, width 3.66 mm. Form nearly round, slightly elongate, widest at middle of elytra. Color yellowish red; vertex of head and median one-third of pronotum black; elytron entirely reddish purple. Head finely punctured, punctures separated by their diameter or less; covered with dense, grayish white pubescence; inner margin of eye feebly rounded. Pronotum finely punctured, punctures separated by 1 to 4 times their diameter; covered with grayish white, semi-decumbent pubescence. Elytron with punctures coarser than on pronotum, separated by their diameter or less; covered with grayish white, semi-erect pubescence. Abdomen with last sternum slightly emarginate. Genitalia with basal lobe shorter than paramere, anterior one-half narrower than basal one-half in ventral view, narrowed before blunt apex in lateral view; paramere gradually widened toward apex (fig. 28, 29); sipho long, slender, acuminate at apex (fig. 30).

Female.–Not known.

Holotype.–Male. Guatemala: "ex Guatemala", N. Orleans 60-20819 (USNM 71726).

Paratype.–Total 1. Same data as holotype. (USNM).

Externally *weisei* most nearly resembles the dark form of *A. punica*, but the lateral red area of the pronotum occupies one-third of the elytron in *weisei* and is only a narrow border in *punica*. The male genitalia are quite different in the 2 species. The 2 type specimens were intercepted by Plant Quarantine inspectors at New Orleans and are labeled as being from Guatemala.

Anovia peruviana, n. sp.

Female.–Length 4.00 mm, width 3.59 mm. Form oval, widest near middle of elytra. Color black; metasternum, anterior and middle tibiae, hind legs and abdomen brownish yellow. Head finely punctured, punctures separated by their diameter or less; covered with grayish white, nearly

erect pubescence; inner margin of eye distinctly rounded, not parallel, divergent toward lower margin of eye. Pronotum very finely punctate, punctures finer than on head, separated by 1 to 4 times their diameter; covered with grayish white pubescence. Elytron finely punctured, punctures subequal to punctures on head, separated by 1 to 2 times their diameter; covered with grayish white, nearly erect pubescence.

Holotype.–Female. Peru: Tingo Maria, 1949, J. Dieguez (USNM 71727).

The type is unique and is the only specimen of the genus seen from as far south as Peru. The large size, divergent eyes and shining, black dorsal surface separate it from any presently known species of *Anovia*.

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